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producing a phase conjugate beam of the second beam received from said micro-mirror by a broad area intracavity predetermined phase conjugator.

REMARKS

The foregoing amendments are responsive to the Office Action mailed on May 22, 2002. Claims 1-44 were originally in the application. Claims 45-49 were added by a previous amendment. Therefore, claims 1-49 are pending in this application and are presented for examination.

Attached to this response is a version showing the changes made, titled "Version With Markings To Show Changes Made." In view of Applicant's amendments and arguments discussed hereinafter, allowance of claims 1-49 is respectfully requested.

Brief Discussion of the Invention

The present invention comprises a system and method of remotely extracting information from a communications station by an interrogating beam. Nonlinear phase conjugation of the low power beam results in an encoded return beam that automatically tracks the input beam and is corrected for atmospheric distortion. Intracavity (i.e., self-contained) nondegenerate four wave mixing is used in a broad area (i.e., a two-dimensional multi-mode device structure) semiconductor laser in the communications station to produce the return beam.

Discussion of the Office Action

In the Office Action of May 22, 2002 the Examiner rejected claims 34-35 under 35 U.S.C. §102(b) as being anticipated by Akkapeddi (US Patent No. 4,949,056 A). She

rejected claims 42-44 under 35 U.S.C. §102(b) as being anticipated by Pepper et al. (US Patent No. 5,038,359 A). She rejected claim 34 under 35 U.S.C. §102(b) as being anticipated by Sharp et al. (US Patent No. 5,317,442 A). She rejected claims 1-17, 40-41, and 45-47 under 35 U.S.C. §103(a) as being unpatentable over Akkapeddi in view of Watanabe (US Patent No. 5,920,588 A) and Pepper et al. (US Patent No. 5,038,359 A). She rejected claims 18-21, 48, and 49 under 35 U.S.C. §103(a) as being unpatentable over Akkapeddi in view of Watanabe. She rejected claims 22-23 under 35 U.S.C. §103(a) as being unpatentable over Akkapeddi et al. or Sharp et al. in view of Watanabe and Damen et al. (US Patent No. 5,675,436 A). She rejected claims 24, 26-29, and 30-33 under 35 U.S.C. §103(a) as being unpatentable over Watanabe in view of MacDonald (US Patent No. 5,519,723 A). She rejected claim 25 under 35 U.S.C. §103(a) as being unpatentable over Watanabe et al. (US Patent No. 5,920,588 A), in view of MacDonald (US Patent No. 5,519,723 A), and further in view of Damen et al. In addition, the Examiner rejected claims 35-39 under 35 U.S.C. §103(a) as being unpatentable over Sharp et al. in view of Pepper et al.

Rejection of claims 34-35 under 35 U.S.C. §102(b)

As set forth above, claims 34-35 were rejected under 35 U.S.C. §102(b) as being anticipated by Akkapeddi (US Patent No. 4,949,056 A). Applicants respectfully traverse the rejection.

With regard to claim 34, the Examiner references Figure 1 in Akkapeddi and additionally references (Column 2, lines 15-60) in Akkappedi and states that Akkappedi discloses a system that anticipates Applicant's claim 34.

Applicant's claim 34, element 3 (i.e., a means for returning a phase conjugate beam to the transmitting....) has been amended to include the limitation, wherein the station includes a broad area intracavity phase conjugator for returning a phase conjugate beam to the transmitting and receiving means. Thus, Applicant respectfully submits that claim 34 should not be rejected on the basis of Akkapeddi (US Patent No. 4,949,056 A), because Akkapeddi does not teach every aspect of Applicant's invention pertaining to claim 34. Under §MPEP 2129, "[t]o anticipate a claim, the reference must teach every element of the claim."

Applicant respectfully submits that Akkapeddi **does not disclose or suggest** anywhere the use of **an intracavity** (i.e., self-contained) phase conjugator nor does Akkapeddi disclose or suggest anywhere a **broad area** (i.e., a two-dimensional multi-mode device structure) device in combination with an intra-cavity phase conjugator for returning a phase conjugate beam to the transmitting and receiving means as claimed by Applicant. Akkapeddi instead discloses a phase conjugator that utilizes a pump laser and a non-linear crystal, combined with a Raman amplifier as part of the system that returns an interrogating laser beam back to the beam source. For example, Akkappeddi (See specification, Column 2, lines 34-39) states: "Fig. 2 illustrates a phase conjugator 16 employing four wave mixing....It comprises a non-linear crystal 18, such as Ruby....Crystal 18 is irradiated by a tunable laser." Column 2, lines 45 –51, in Akkappeddi states, "[t]he phase conjugated Raman wavefront λ_R is then amplified in Raman amplifier 12 which is pumped at the same frequency. The amplified λ_R ...may now be used as the high energy laser beam for the upward link propagation to the

satellite." Conversely, Applicant claims a broad area (i.e., a two-dimensional multi-mode device structure), intracavity (i.e., self-contained) phase conjugator that returns a phase conjugate beam to a transmitting and receiving source. Applicant, in describing the claimed broad area in combination with an intra-cavity device, (See page 8, lines 8-12) states, "[t]he interrogating beam 302 operating at frequency ω_1 contains phase information regarding the atmospheric distortions and will essentially trigger the diode laser oscillator of the broad area diode laser micro-phase conjugator 334 to pump the beam via intracavity four wave mixing." Applicant in describing broad area (see specification, page 6, lines 13-21) states, "[b]road area laser micro-phase conjugators function as actively-modulated retroreflectors which amplify and encode an interrogating laser beam and return it precisely to the beam source....Broad area also indicates that the micro-phase conjugators are multimode (spatially)."

Accordingly, in light of the amendment to claim 34, this ground of rejection of claim 34 under 35 U.S.C. §102(b) is believed improper and should be withdrawn.

With regard to **claim 35**, the Examiner references Figure 1 in Akkapeddi and additionally references (Column 2, lines 32-34, and lines 15-60) in Akkappeddi and states that the reference discloses a method that anticipates Applicant's claim 35.

Applicant's claim 35 has been amended to include the additional step of, producing a phase conjugate beam of said interrogating beam by a broad area intracavity phase conjugator. Thus, Applicant respectfully submits that claim 35 should not be rejected on the basis of Akkapeddi (US Patent No. 4,949,056 A), because the

reference does not disclose or suggest every aspect of Applicant's invention, (i.e., Applicant's broad area intra-cavity phase conjugator).

Accordingly, in light of the amendment and based on similar arguments discussed above in the rejection of claim 34 under 35 U.S.C. §102(b), this ground of rejection of claim 35 under 35 U.S.C. §102(b) is believed moot and should be withdrawn.

Rejection of claims 42-44 under 35 U.S.C. §102(b)

As set forth above, **claims 42-44** were rejected under 35 U.S.C. §102(b) as being anticipated by Pepper et al. (US Patent No. 5,038,359 A). Applicant respectfully traverses the rejection.

Regarding **Claim 42**, the Examiner states that "Pepper et. al disclose a method of providing an optical interconnect comprising: transmitting an interrogating beam from a fiber optic device; receiving the interrogating beam at a micro-mirror 16 across free space; transmitting a second beam from micro-mirror to a predetermined phase conjugator 12."

Applicant's claim 42 has been amended to include the additional step of, producing a phase conjugate beam of the second beam received from said micro-mirror by a broad area intracavity predetermined phase conjugator. Thus, Applicant respectfully submits that that claim 42 and dependent claims thereof should not be rejected on the basis of Pepper et al. (US Patent No. 5,038,359 A), because the reference does not disclose or suggest every aspect of Applicant's claimed invention.

Applicant respectfully submits that Pepper et al. **does not disclose or suggest anywhere** that the phase conjugator used in Pepper is **an intracavity phase conjugator**

nor does Pepper disclose or suggest the combination of a broad area intracavity phase conjugator in a semi-conductor package as taught by Applicant. For example, Pepper et al. (Figure 1, Column 5, lines 29-30), describes a phase conjugate apparatus that "includes a non-linear medium 12 capable of two wave mixing by SPS." SPS was defined in Pepper (Column 1, line 36) as "stimulated photorefractive scattering." Thus, Pepper et al. requires a non-linear medium (i.e., a crystal) as part of a phase conjugation system, which incorporates the photorefractive effect. Applicant, conversely, as discussed herein before in the rejection of claim 34 under 35 U.S.C. 102(b), as applied to Akkapedi, claims a broad area (i.e., multimode) intracavity (i.e., self-contained) semiconductor device.

Thus, this ground of rejection of claim 42 and dependent claims thereof under 35 U.S.C. §102(b) is deemed improper and should be withdrawn.

Rejection of claims 34 under 35 U.S.C. §102(b)

As set forth above, **Claim 34** was rejected under 35 U.S.C. §102(b) as being anticipated by Sharp et al. (U.S. Patent No. 5,317,442 A). The Examiner references Figures 2 and 5, and column 2, lines 26-42, in Sharp et al., in rejecting claim 34.

Claim 34 was amended to include the limitation, "wherein the station includes a broad area intracavity phase conjugator." Applicant respectfully submits that Sharp et al. neither discloses nor suggests anywhere the use of **an intracavity** (i.e., self-contained) phase conjugator nor does Sharp disclose or suggest anywhere a **broad area** (i.e., a two-dimensional multi-mode device structure) device in combination with an intra-cavity phase conjugator for returning a phase conjugate beam to the transmitting

and receiving means as claimed by Applicant. Instead, Sharp et al. teaches a photorefractive phase conjugator that incorporates a photorefractive material coupled with a pump laser source as part of Sharp's phase conjugation apparatus. For example, Sharp et al. states in (Column 3, lines 6-10), " [r]eferring now to the drawings, and more particularly to Fig.1, there is shown a class of photorefractive phase conjugators called mutually pumped (or doubly pumped) phase conjugation mirrors (MPPCM)." Also, Sharp states (Column 3, lines 10-17), "Photorefractive material 10 acts as a phase conjugate mirror for two incoming waves simultaneously." An example of a second pump laser being necessary for phase conjugation is found in (Column 3, lines 66-68 and Column 4, lines 1-2), "[t]o record a phase conjugate signal there must be another laser entering the crystal to supply energy for the signal and simultaneously the other beam is being phase conjugated by pumping beam 22." As stated above in the arguments as to the rejection of claim 34, as applied to Akkapeddi, Applicant's claimed phase conjugation system is an intracavity (i.e., a self-contained device that does not need a second pump source) broad area (i.e., multi-mode) semi-conductor device. It does not use photorefractive materials and it does not incorporate a second pump laser as part of the phase conjugation scheme.

Accordingly, in light of the amendment to claim 34, this ground of rejection of claim 34 under 35 U.S.C. §102(b) is believed moot and should be withdrawn.

Discussion of Rejection of Claims 1-17, 40-41, and 45-47 under 35 U.S.C. §103(a)

Claims 1-17, 40-41, and 45-47 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Akkapeddi (U.S. Patent No. 4,949,056 A) in view of Watanabe (U.S. Patent No. 5,920,588 A) and Pepper et al. (U.S. Patent No. 5,038,359 A).

Regarding claim 1, the examiner indicates that Akkapeddi (Figure 1) disclose a system comprising: a transceiver 10 constructed to transmit an interrogating beam; and a communication station capable of receiving the interrogating beam. The examiner further indicates that Akkapeddi includes a phase conjugator but does not specifically disclose that the communication station includes a plurality of intra-cavity phase conjugators arranged in an array. The Examiner then states that, "Watanabe teaches an intra-cavity conjugator (Figure 2) may be used in a system to produce a phase conjugate beam as in the system disclosed by Akkapeddi." She additionally states that, "Pepper et al. (Figures 9-10; column 10, lines 47-68; column 11, lines 1-17) teach another type of phase conjugator, but also further suggests that phase conjugators may be arranged in an array." The Examiner then states that, "it would have been obvious to use the intra-cavity phase conjugator taught by Watanabe in the system disclosed by Akkapeddi as a way to provide a phase conjugate light beam without requiring a separate source of pump light, and to further arrange the phase conjugators in an array as taught by Pepper et al. to provide a broader area for producing phase conjugation." Applicant respectfully traverses the rejection because 1) the cited references do not teach or suggest all the claim limitations as taught by Applicant, and 2) the references are not properly combinable or modifiable because their intended function is destroyed.

Applicant has amended claim 1 to include broad area as a limitation and is as follows:

A system comprising:

a transceiver constructed to transmit an interrogating beam;
a communications station capable of receiving said interrogating beam; and
said communications station having a plurality of broad area intra-cavity phase conjugators arranged in an array.

First, Applicant respectfully submits that the rejection of claim 1 under 35 USC §103(a) is improper because the references do not teach or suggest all the claim limitations.

Under MPEP §2143.03:

“To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art.” *In re Royka*, 490 F. 2d 981, 180 USPQ 580 (CCPA 1974).

The primary reference (Akkapeddi) does not disclose or suggest anywhere Applicant’s **broad area** (i.e., multimode) intra-cavity device that operates as a phase conjugator. Instead, Akkapeddi teaches a phase conjugator that (as discussed above in the arguments for the 35 U.S.C. §102(b) rejection of claims 34 and 35), needs a pump laser, a non-linear crystal, and a Raman amplifier as part of the system to return a phase conjugated interrogating laser beam back to the source. The Watanabe reference does not disclose or suggest anywhere Applicant’s broad area intra-cavity phase conjugator but instead teaches (See claim 63 and Column 16, lines 17-20), a one-dimensional intra-

cavity phase conjugator (correcting for wavelength dependent timing distortions) that relies on *single spatial mode* operation. By contrast, Applicant claims a **broad area intra-cavity** two-dimensional spatial phase conjugator that requires a specialized “**broad area**” or multimode intracavity laser diode device structure to perform the required spatial phase conjugation in order to achieve an adaptive optics function.

In addition to the differences stated above for Akkapeddi and Watanabe, Pepper et al. teaches a plurality of phase conjugators arranged in an array that uses a non-linear crystal and Stimulated Photorefractive Scattering as part of its phase conjugation scheme but does not disclose or suggest Applicant’s device. Applicant, conversely, discloses and claims a system incorporating **broad area intra-cavity** micro phase conjugators arranged in an array and **not** a non-linear crystal as part of his phase conjugation system and **not** by Stimulated Photorefractive Scattering as a means to phase conjugate.

Therefore, it is respectfully submitted that the disclosures of Akkapeddi, Watanabe and Pepper et al. fail the obviousness test because the references do not teach or suggest key elements of Applicant’s apparatus claim 1 and dependent claims thereof.

Second, Applicant submits that the combination of the cited references would destroy their intended function. The CCPA and the Federal Circuit have consistently held that:

“when a §103 rejection is based upon a modification of a reference that destroys the intent, purpose or function of the invention disclosed in the reference, such a proposed modification is not proper and the

prima facie case of obviousness can not be properly made." *In re* Gordon, 733 F. 2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

The Watanabe work is based on the use of intracavity four-wave mixing and phase conjugation for the purpose of removing the effects of chromatic dispersion and pulse distortion in fiber communication systems and **not** for producing a spatially conjugated beam. For example Watanabe states, (See Column 16, lines 17-20), "An optical fiber 2 is optically connected through a lens 3 to a first end of a DFB laser diode 1, and an optical filter 10 is optically connected through a lens 6 and an optical fiber 4 to a second end of the DFB laser diode 1." As another example, Watanabe claims (See claim 63) "A device,...wherein said optical fiber has a zero-dispersion wavelength substantially equal to a wavelength of said pump light." Watanabe in essence teaches and claims a one-dimensional phase conjugator (correcting for wavelength dependent timing distortions) that relies on *single spatial mode* operation.

Like Applicant's invention, Akkapeddi and similar references addresses the issue of two-dimensional spatial phase conjugation for communicating through the atmosphere but is based on different physical phenomenology as opposed to Applicant's invention (i.e., Akkapeddi does not suggest or disclose anywhere the claimed **broad area, intra-cavity** electrically pumped micro-phase conjugator described by Applicant). Nonetheless, the proposed modification in the examiner's rejection, i.e., taking the system described in Akkapeddi and simply replacing Akkapeddi's nonlinear crystal phase conjugator and Raman amplifier with the intracavity four-wave mixing DFB laser diode phase conjugator described in Watanabe, would render the system in

Akkapeddi inoperable because the proposed modification **would not produce a spatially** phase conjugated beam. Intracavity four-wave mixing in single-mode DFB laser waveguide described by Watanabe would spatially filter the atmospherically aberrated input beam, destroying the spatial information required to produce the spatially phase conjugated retro-beam. Applicant however, solves this problem by claiming a specially designed broad area diode laser structure that allows the spatial information of an aberrated input beam to be phase conjugated producing an amplified retro-beam.

Accordingly, Applicant respectfully submits that there is nothing in any of the cited references to teach, suggest or provide incentive in support of the combination of elements recited in applicant's claim and the references cited, if combined, would render the modification inoperable. Therefore, the rejection of claim 1 under 35 U.S.C. §103(a) and dependent claims thereof is deemed improper and is requested to be withdrawn.

Regarding method claims **40** and **41**, the Examiner makes the same arguments as to the obviousness of the claims as made in the rejection of claim 1 under 35 U.S.C. §103(a) as discussed above. Applicant has amended claims 40 and 41 to include the limitation broad area. In light of the amendments and in light of similar arguments discussed above in the rejection of claim 1 under 35 U.S.C. §103(a), the rejections are deemed moot and are requested to be withdrawn.

Regarding **claims 45-47**. Claim 45 depends on claim 1. Claim 47 depends on claim 46, which depends on claim 1. In light of the above arguments for claim 1, the

rejection of claims 45-47 under U.S.C. §103(a) is believed moot and is requested to be withdrawn.

Discussion of Rejection of Claims 18-21, and 48-49 under 35 U.S.C. §103(a)

Claims 18-21 and 48-49 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Akkapeddi in view of Watanabe. The Examiner states that it would have been obvious to use the intra-cavity phase conjugator taught by Watanabe in the system disclosed by Akkapeddi as a way to provide a phase conjugate light beam without requiring a separate source of pump light. Applicant has amended claim 18 to include the limitation broad area. Thus, Applicant respectfully traverses the rejection of claim 18 and dependent claims 48-49, which contains the limitations of claim 18.

Accordingly, in light of the amendment and based on similar arguments discussed above in the rejection of claim 1 under 35 U.S.C. §103(a), it is respectfully submitted that this rejection of claim 18 and dependent claims 48 and 49, under 35 U.S.C. §103(a) is without proper basis, is improper, and should be withdrawn.

Discussion of Rejection of Claims 22-23 under 35 U.S.C. §103(a)

As set forth above, **claim 22 and 23** stand rejected under 35 U.S.C. §103(a) as being unpatentable over Akkapeddi et al. or Sharp et al., in view of Watanabe and Damen et al. (U.S. Patent No. 5,675,436 A).

Regarding **claim 22**, the Examiner references Figures 1 and 2 in Akkapeddi and Figures 2 and 5 in Sharp et al. The Examiner states, "that neither Akkapeddi nor Sharp specifically disclose that the phase conjugator may be an intra-cavity phase conjugator which is a VCSEL structure." However the Examiner states that, "Watanabe

teaches that an intra-cavity conjugator ... may be used in a system to produce a phase conjugate beam as in the system disclosed by Akkapedi or Sharp." The Examiner also states, "Watanabe teaches that the phase conjugator may comprise a broad-area, distributed feedback laser device ... but does not teach specifically that it may be a VCSEL structure." The Examiner additionally states that, "Damen et al. ... teach that a VCSEL structure may be used to provide a nonlinear element for four wave mixing as taught by Watanabe." The Examiner then states that, "it would have been obvious to use the intra-cavity phase conjugator which is a VCSEL structure taught by Watanabe and Damen in the system taught by Akkapedi or Sharp as a way to provide a phase conjugate light beam without requiring a separate source of pump light." Such a rejection is respectfully traversed because 1) all the claim limitations are not taught or suggested by the cited references, and 2) there is no basis in the art for combining or modifying the references to arrive at applicants' claimed invention.

Applicant has amended claim 22 to include the limitation broad area. Thus, Applicant respectfully submits that all the claim limitations taught by Applicant are not disclosed or suggested by the cited references. In arguments discussed above, as applied to the rejection of claim 1 under 35 U.S.C. §103(a), Akkappedi does not suggest or disclose anywhere the type of broad area (i.e., multimode), intra-cavity (i.e., self-contained), electrically pumped micro-phase conjugator described and claimed by Applicant. Watanabe does not disclose or suggest a broad area intra-cavity phase conjugator as stated by the Examiner but instead Watanabe teaches and claims a one-dimensional phase conjugator (correcting for wavelength dependent timing distortions)

that relies on single spatial mode operation. **Sharp et al.** does not disclose or suggest anywhere an intra-cavity broad area phase conjugator as taught by Applicant but instead discloses (Figures 2 and 3, and Column 3, lines 1-68, Column 4, lines 1-13) an **external pump** laser source as an input beam to establish a beam fan in a photorefractive mutually pumped phase conjugation arrangement. **Damen et al.** discloses an optical image processor that as one embodiment uses a VCSEL structure in a four wave mixing configuration but nowhere is it suggested or disclosed that the VCSEL is a broad area intra-cavity device as claimed by Applicant.

Additionally, there must be a basis in the art for combining or modifying the references to arrive at applicants' claimed invention.

"Obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching, suggestion or incentive supporting the combination." *ACS Hospital Systems, Inc. v. Montefiore Hospital*, 221 USPQ 929, 933 (Fed. Cir. 1984) and *In re Geiger*, 2 USPQ2d at 1278 (Fed. Cir. 1987).

As stated above in the argument for the rejection of claim 1 under 35 USC 103(a), the combination of Akkapeddi and Watanabe would produce an inoperable system. **Sharp et al.** discloses a system that utilizes photorefractive materials as part of its phase conjugation apparatus. Furthermore, **Sharp's** system is designed for two-dimensional spatial phase conjugation for communicating through the atmosphere similar to Akkapeddi, which is inoperable if combined with Watanabe's single mode intra-cavity device. **Damen et al.** discloses an optical image processor that as one

embodiment uses a VCSEL structure in a four wave mixing configuration but there is no suggestion in the reference that a VCSEL can be used as the phase conjugator as taught by Applicant.

Accordingly, because the references do not disclose or suggest nor provide an incentive (e.g., inoperable combinations), for combining such diverse technologies to produce Applicant's invention, this ground of rejection of claim 22 under 35 U.S.C. §103(a) is improper and should be withdrawn

As set forth above, **claim 23** is rejected under 35 U.S.C. §103(a) over Akkapeddi et al. or Sharp et al., in view of Watanabe and Damen et al. (U.S. Patent No. 5,675,436 A). The rejection is respectfully traversed.

Claim 23 depends on claim 22. In light of the above arguments for claim 22, such an issue is believed moot and the rejection of claim 23 under 35 U.S.C. §103(a) is requested to be withdrawn.

Discussion of Rejection of claims 24, 26-29, and 30-33 under 35 U.S.C. §103(a)

Claims 24, 26-29, and 30-33 stand rejected under 35 U.S.C. §103(a) over Watanabe in view of MacDonald (U.S. Patent No. 5,519,723 A). Applicant respectfully traverses the rejection. The Examiner states that, "Watanabe discloses an optical interconnection system (Figure 2) comprising: a fiber device (fiber 2) constructed to transmit an interrogating beam (omega s) to a predetermined intra-cavity phase conjugator 1." In addition, the examiner states that it would have been obvious to a person of ordinary skill in the art to use a mirror taught by MacDonald in the system disclosed by Watanabe. Applicant respectfully traverses the rejection.

Applicant has included the limitation of broad area into claim 24. As discussed above for the rejection of claim 1 under 35 U.S.C. §103(a), the Watanabe reference teaches a one-dimensional phase conjugator (correcting for wavelength dependent timing distortions) that relies on *single spatial mode* operation. By contrast, Applicant teaches and claims a *two-dimensional spatial phase conjugator* that requires a specialized “**broad area intra-cavity**” or multimode intracavity laser diode device structure to perform the required spatial phase conjugation in order to achieve an adaptive optics function. Therefore, the **Watanabe** intra-cavity device **would not provide an incentive** for one skilled in the art to combine with MacDonald to replace Applicant’s claimed broad area intra-cavity device because as argued above in the rejection of claim 1 under 35 U.S.C. §103(a), the Watanabe device would render Applicant’s invention inoperable with or without the mirror taught by MacDonald.

Accordingly, in light of the amendment and prior arguments, as applied to Watanabe, the rejection of claim 24 under 35 U.S.C. §103(a) is rendered moot.

As set forth above, **claims 26-29 and claims 30-33 stand rejected under 35 U.S.C. §103(a) over Watanabe in view of MacDonald (U.S. Patent No. 5,519,723 A).** Claims 26-31 depend on claim 24, claims 32-33 depend on claim 30 which depends on claim 24. In light of the amendment of claim 24 and arguments discussed above for claim 24, the rejection of claims 26-29 and claims 30-33 under 35 U.S.C. §103(a) is believed improper and is requested to be withdrawn.

Discussion of Rejection of claim 25 under 35 U.S.C. §103(a)

Claim 25 stands rejected under 35 U.S.C. §103(a) over Watanabe in view of MacDonald (U.S. Patent No. 5,519,723 A) and further in view of Damen. In light of the above arguments for the rejection of claim 24 under 35 U.S.C. §103(a) in discussing Watanabe not providing an incentive to replace Applicant's broad area intra-cavity phase conjugator and because claim 25 depends on claim 24, the rejection is deemed moot and is requested to be withdrawn.

Discussion of Rejection of claims 35-39 under 35 U.S.C. §103(a)

Claims 35-39 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Sharp et al. in view of Pepper et al. This rejection is respectfully traversed.

Regarding claims 35 and 36, Applicant has amended claim 35 to include the additional step, producing a phase conjugate beam of said interrogating beam by a broad area intracavity phase conjugator and claim 36 to include the additional step, producing a phase conjugate beam of said interrogating beam, wherein each of said phase conjugators arranged in said array comprise a broad area intracavity micro phase conjugator.

Under MPEP §2142,

"The prior art reference (or references when combined) must teach or suggest all the claim limitations."

Pepper et al. does not disclose nor suggest anywhere “broad area intra-cavity” semi-conductor four wave mixing. Pepper et al. (Figure 1, Column 5, lines 29-30), describes a phase conjugate apparatus that “includes a non-linear medium 12 capable of two wave mixing by SPS.” SPS was defined in Pepper (Column 1, line 36) as “stimulated photorefractive scattering.” Pepper et al. does teach a four-wave mixer (Column 10, lines 23-46, and Fig. 8) but the non-linear photorefractive medium is part of the embodiment. The Applicant, conversely, describes in his application (Figure 4, page 10, lines 5-7), “Figure 4 is an elevational view of the non-degenerative four wave mixing (NDFWM) in broad area (multimode) semiconductor laser diodes 334 (rather than passive photorefractive crystals)....” Thus, Pepper et al. requires a non-linear medium (i.e., a crystal) as part of a phase conjugation system, which incorporates the photorefractive effect whereas Applicant utilizes a self-contained, “broad area intra-cavity” phase conjugation system in a semiconductor package.

Sharp et al. does not disclose or suggest anywhere a “broad area intra-cavity” phase conjugator as claimed by Applicant but instead discloses (Figures 2 and 3, and Column 3, lines 1-68, Column 4, lines 1-13) an **external** pump laser source as an input beam to establish a beam fan in a photorefractive mutually pumped phase conjugation arrangement.

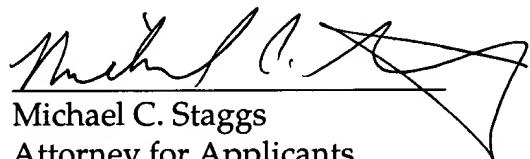
Accordingly, because the references do not teach or suggest all the claim limitations, nor is there any incentive to combine the references, the references fail to support a rejection of claims 35, 36 and dependent claims thereof under 35 U.S.C. §103(a) and is requested to be withdrawn.

Conclusion

In view of Applicant's amendments and arguments, allowance of claims 1-49 is respectfully requested. The Applicant respectfully submits that no new matter has been introduced by these amendments to the claims.

In the event that the Examiner finds any remaining impediment to the prompt allowance of these claims that can be clarified with a telephone conference, she is respectfully requested to initiate the same with the undersigned at (925) 422-3682.

Respectfully submitted,



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Dated: 8/21/02

VERSION WITH MARKINGS TO SHOW CHANGES MADE

1. (Twice Amended) A system comprising:

a transceiver constructed to transmit an interrogating beam;

a communications station capable of receiving said interrogating beam;

and

said communications station having a plurality of broad area intra-cavity phase conjugators arranged in an array.

18. (Twice Amended) A system comprising:

a transceiver constructed to transmit an interrogating beam;

a communication station capable of receiving said interrogating beam;

and

said communication station having a[n] broad area, intra-cavity phase conjugator with a top electrode, wherein an electrode is located in said top electrode.

22. (Twice Amended) A system comprising:

a transceiver constructed to transmit an interrogating beam;

a communication station capable of receiving said interrogating beam;

and

said communication station having a[n] broad area intra-cavity phase conjugator which is a VCSEL structure.

24. (Twice Amended) An optical interconnection system comprising:

a fiber optic device constructed to transmit an interrogating beam; and

a micro-mirror adapted to receive said interrogating beam and transmit the beam to a predetermined broad area intra-cavity phase conjugator.

34. (Twice Amended) A system comprising:

a means for transmitting and receiving an interrogating beam; and
a communication station operatively coupled to said transmitting and receiving means, wherein the station includes a broad area intracavity phase conjugator [and having a means] for returning a phase conjugate beam to said transmitting and receiving means.

35. (Amended) A method comprising:

transmitting an interrogating beam from a transceiver;
receiving said interrogating beam at a communication station;
producing a phase conjugate beam of said interrogating beam by a broad area intracavity phase conjugator;
encoding data onto said [a] phase conjugate beam [data] and pumping [the] an encoded phase conjugate reflectivity by nondegenerate four wave mixing;
and
transmitting [the] said encoded phase conjugate beam back to the receiver.

36. (Amended) A method comprising:

transmitting an interrogating beam from a transceiver;
receiving said interrogating beam at an array of phase conjugators;

producing a phase conjugate beam of said interrogating beam, wherein
each of said phase conjugators arranged in said array comprise a broad area
intracavity micro phase conjugator;

modulating data onto [a] said phase conjugate beam; and

transmitting the phase conjugate beam back to said transceiver.

40. (Twice Amended) A method comprising:

transmitting an interrogating beam from a transceiver;

receiving said interrogating beam at an array of broad area, intra-cavity phase conjugators through apertures located in the top electrodes of the phase conjugators;

modulating data onto a phase conjugate beam; and

transmitting the phase conjugate beam to said transceiver.

41. (Twice Amended) A method comprising:

transmitting an interrogating beam from a transceiver;

receiving said interrogating beam at an array of broad area, intra-cavity phase conjugators and resolving a substantial portion of the spatial components of the input wavefront of the interrogating beam;

modulating data onto a phase conjugate beam; and

transmitting the phase conjugate beam to said transceiver.

42. (Twice Amended) A method of providing an optical interconnect comprising:

transmitting an interrogating beam from a fiber optic device;

receiving said interrogating beam at a micro-mirror across free space;
transmitting a second beam from said micro-mirror [to a predetermined
phase conjugator.]; and
producing a phase conjugate beam of the second beam received from said
micro-mirror by a broad area intracavity predetermined phase conjugator.